E. CIVIL DESIGN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PLATES

 (figures are continued on next page)

CHAPTER 1

1.1 Folsom Dam Enlargement Plan

Three Folsom Dam enlargement plans were quantified: (1) A 12-foot raise with maximum flood pool elevation of 487.0 feet and raised dam elevation of 492.5 feet; (2) A 7.0-foot raise with maximum flood pool elevation of 482.0 feet and raised dam elevation of 487.5 feet; (3) A 3.5-foot raise with maximum flood pool elevation of 478.0 feet and raised dam elevation of 484.0 feet. The earth dams and dikes that would be enlarged or raised are Dikes 1-8, Mormon Island Dam, Right Wing Dam, and Left Wing Dam. The existing elevation of all dikes and dams is 480.5 feet. See Plates 1-8 for plan view of dam raise alternatives, and Plates 9-12 for typical cross sections of the12-foot dam raise.

Each dam enlargement alternative would have the same construction techniques, so the only difference would be the height of raise for each alternative. The first stage of construction would be to clear existing material from the side slopes of the dam from the toe of fill, up the side slopes, and onto to the crest of existing dam (or dike) a horizontal distance of 8 feet. This is to allow access for a dozer with blade or dump bucket to remove material. The waterside material on the dikes and dams is riprap on the outer edge and dredge tailings are adjacent to the riprap. The amount of riprap and dredge tailings to be removed was determined from the as built plans of the existing dams and dikes. The landside dikes and dams have miscellaneous sized dredge tailings on the outer 8-foot layers that would be removed. Both sides of the dikes and dams would then be raised in lifts, importing new material for the raise, and using existing material that was removed. The interior zones of material would then be constructed to conform as much as possible to the original design of dams and dikes. Aggregate base and asphalt pavement would be removed from the top of the dams and dikes. Some dikes and dams are presently being used as access roads and bike trails.

Borrow Areas

Embankment material would be obtained from the Mississippi Bar area on the right bank of Lake Natoma with an area of approximately 140 acres as shown on Plate 5-9A in Volume I of Report. The materials from this site would be course materials such similar to the dredge tailings in existing dams and dikes. The Peninsula area on the east side of the dam between the north fork and south fork of the American River with an area of approximately 90 acres as shown on Plate 5-9B in Volume I. Material from this site would mostly fine materials to be used for the impervious zones within the dams and some dikes. Other potential borrow areas are between Beals Point and Mooney Ridge with exposed granite at elevations below 440 feet, the hill on right side of left wing dam abutment and to the right of Folsom Dam Road, and stockpiled material from preliminary foundation work at Auburn Dam and a cofferdam downstream of dam foundation area which failed in 1996. This site is downstream from the cofferdam site on the North Fork of the American River.

The haul distance from Mississippi Bar to the right wing dam is approximately 5 miles. The most desirable route would be to travel north up Main Street, east on Madison Avenue, north on Greenback Lane, and north on Auburn Folsom Road, and to the right wing dam on Folsom Dam Road. This site would be considered a very good site for borrow for the potentially large volumes of fill needed at dams and dikes since it is close to dams, publicly owned, and accessible on a year-round basis. A less desirable route, because of cost increases, would be to barge the material across Lake Natoma and haul it up Auburn Folsom Road to Folsom Dam Road. Another possible route for Mormon Island Dam, Dike 7 and 8, is to travel down Highway 50 to Auburn Folsom Road to Blue Ravine Road to Green Valley Road. The material from Mississippi Bar would be mostly material similar to dredge tailings used in the existing dam.

The haul distance from the peninsula borrow site would be between 2 and 3 miles to the dams and dikes. The material would be used mostly for the impervious core of the dams and dikes that have existing impervious core, and miscellaneous other areas such as access roads ramping over dikes. The embankment would be barged across Folsom Lake to the dikes and dams.

Dikes 1,2, and 3

Dikes 1,2, and 3 would be raised using materials similar to the existing dredge tailings in the existing dikes. Riprap would be placed on the waterside of the embankments. Three access roads into the Granite Bay State Park Recreation Area would have to be ramped up and over the raised embankment, and the access road on top of the dikes to these access areas would have to be reconstructed. The waterside slope would be 2.25 horizontal to 1 foot vertical (2.25: 1). The landside slopes would be 1.75:1. On the crest of the raised dikes on the waterside of the raised embankment, a 3.5-foot reinforced concrete crest wall would be constructed along the waterside slopes of the dikes. Riprap would be placed up to the waterside foundation of the 3.5-foot concrete crest wall to protect against wind and wave action as shown on Plate 12. The existing riprap would be used for most of the waterside embankments, but some riprap would be imported from commercial sources. In areas where the access roads cross the embankment, the dike embankment would be raised 3.5 feet higher to maintain the same elevation as the crest walls. The crest width would be 21 feet.

Mooney Ridge

At Mooney Ridge, one alternative would be constructing a new embankment within Government property to protect houses in the area. If a new embankment were constructed, there would be a 20-foot wide crest width with side slopes of 2.5:1 on the waterside and 2.25:1 on the landside. A flap gate culvert would be placed under the embankment to drain local runoff on the landside of the embankment. A second alternative would be a berm with a 3 to 1 waterside slope up to the flood pool elevation at the property line and fill backyard slopes of the homes at the same flood pool elevation. The berm would not be extended across a 280-foot width of Government owned property, which extends up to Lakeshore Drive, so a culvert would not be needed to drain local runoff. See Plates 12A through 12C for plan and cross section views of berm plan.

Another alternative would be to purchase a flood easement up to the design flood pool elevation. This plan would include the purchase one home that would be flooded at the 487-foot flood pool elevation, or flood protection for this home with a reinforced concrete retaining wall for the 487-foot flood pool elevation. The flood protection plan for the concrete retaining wall is shown on Figure 1.

Dikes 4,6, and 8

Dikes 4, 6, and 8 would have a crest width of 21 feet, with 2.25:1 slopes on the waterside and 1.75:1 on the landside. Each would have a 3.5-foot high crest wall on top of the dam on the waterside of crest. The riprap side slopes on the waterside of the embankment would be rebuilt from existing and imported rock. A 3.5-foot reinforced concrete crest wall would be constructed on the waterside crest of the dikes. Riprap would be placed up to the waterside foundation of the 3.5-foot concrete crest wall.

Dikes 5 and 7

Dikes 5 and 7 are the same configuration as dikes 4, 6 and 8, except the existing dikes contain impervious cores at elevation 466 feet. After construction is finished, a slurry wall would be excavated in the middle of the crest of each dike from the top of raised dam down to the core material at elevation 466. The slurry would be a mixture of sand, clay, and cement. The riprap side slopes on the waterside of the embankment would be rebuilt from existing and imported rock. A 3.5-foot reinforced concrete crest wall would be constructed on the waterside crest of the dikes, with riprap placed up to the waterside foundation of the crest wall.

Right Wing and Left Wing Dam

The right wing and left wing dam would be constructed with an impervious core from existing core, which is 12 feet wide to top of raised dam. Interior materials would be similar to existing materials. The riprap side slopes on the waterside of the embankment would be rebuilt from existing and imported rock. Between dike 6 and the right wing dam an access road to Beals Point State Park Recreation Area would be ramped up and over the raised dam, as well as ramps up to the top of dam for the State Park bicycle trail and a maintenance road into Beals Point. Folsom Dam Road would also have to be raised to merge into the raised dam. For the maximum raise of 12 feet, the grade of this road would be increased from about 4 percent to 5 per cent. A 350-foot long retaining wall would be constructed between the right wing dam and Folsom Dam Road in the area where the road and dam merge. This would keep rock from the dam from falling onto the road. The side slopes on the waterside of the raised embankment would be 1.75:1, and the landside slopes would be 1.5:1. The side slope for Folsom Dam Road would be 1.5:1. From the left wing dam, Folsom Dam Road extends to the southeast. This road would be raised to be 1-foot above the design flood pool elevation after it has been ramped off the dam embankment. The crest width of the left and right wing dam would be 26 feet and would have a 3.5 foot high concrete crest wall on the water side of the raised embankment., with riprap placed up to the waterside foundation of the crest wall. The right and left wing dam would transition into the raised concrete portion of the dam.

Mormon Island Dam

Mormon Island Dam would have a slurry wall constructed down the middle of the dam to meet with existing core material at elevation 466 feet. The crest width of the dam would be 21 feet with a 3.5-foot concrete crest wall on the waterside of raised embankment , with riprap placed up to the waterside foundation of the crest wall. The side slopes on the waterside of dam would be 2:1, and 1.75:1 on the landside. Mormon Island Dam has a lot of instrumentation on top and within the dam. There are vibrating wire piezometers, strong motion accelerometer, observation wells, and survey control and monitoring monuments. There is also an instrument house on the east side of the dam. With the side slopes as designed at this time, and with care, the piezometers and observation wells can be avoided. The survey control monuments would have to be established, removed, then replaced back into the correct position after the dam has been raised. The instrument house would have to be raised to at least the same height as the dam raise. The strong motion accelerometer would have to be removed along with wires connecting it to the instruments in the instrument house, and placed back in original location after the instrument house has been relocated and the dam raise and slurry wall is complete.

Minimum Permanent Bridge

This alignment consists of a two-lane roadway and bridge structure across the American River approximately 1000 feet downstream of Folsom Dam. The roadway and bridge would be used for traffic normally using Folsom Dam Road across the dam during the construction of the raised dam. When the dam raise is completed, the traffic would resume along the raised Folsom Dam Road. The road and bridge would then be used as an operation and maintenance road. The roadway would be designed for a speed of 45 miles per hour (mph), but would be posted for a speed of 25 mph. See Plates 13 and 14 for plan view and Plate 15 for profile view. Two alignments are being considered at this time, but the only difference would be near the Bureau of Reclamation complex near the intersection of Auburn Folsom Road and Folsom Dam Road.

One alignment begins at the intersection of Auburn Folsom Road and Folsom Dam Road. The road would pass over the existing underpass for bicycles, but the bicycle underpass would have to be extended to the south to accommodate new road. The road would then go through the Bureau of Reclamation property through a building owned by California State Parks and a Water Education Center, which would both have to be relocated to another site. After crossing the existing route to the powerhouse, the road would parallel the powerhouse road at same grade for 1,000 feet. The road remains parallel to the powerhouse road, but becomes a 1,400-foot elevated structure consisting of precast prestressed "I" girder superstructure with cast-in-place concrete deck. The river bridge structure consists of a 700-foot long, two span steel box girder superstructure. On the east end a 300-foot long elevated structure continues from bridge structure. On the east side, intersections and access would be provided for Folsom Prison, staging areas, and to

City of Folsom water supply pipes. Alignment of road into lower spillway area would be modified as shown on Plates 14 and 15. From the elevated structure, the road continues through sections of cut and fill and merges back into Folsom Dam Road near the left abutment of the left wing dam. The maximum grade on the eastern section of road is 7.0 per cent. The typical roadway section consists of two 11-foot wide traffic lanes and two-foot wide shoulders on each side of roadway. The second alternative is to create a new intersection at Auburn Folsom Road 800 feet south of the existing Auburn Folsom Road - Folsom Dam Road intersection. The alignment would be on a tangent and run between and parallel to the existing bicycle trail and the existing powerhouse road until it would meet the alignment of the roadway of the first alternative. From there, it would follow the same alignment as the first alternative with the same elevated structures, bridge, and road as the first alternative from that point on to the end of roadway. A bicycle underpass would be constructed under the new bridge roadway.

Newcastle Powerhouse

Flood protection for Newcastle Powerhouse would consist of a reinforced concrete ring wall around the perimeter of the roof of the underground powerhouse. A typical section at Newcastle Powerhouse is shown on Figure 2. The ring wall would prevent flooding of the powerhouse through openings in the control room building and the roof on the powerhouse. The powerhouse parking lot would be earth filled to an elevation that would be 1-foot above flood pool elevation each of the three alternatives (elevation 478, 482, and 487). The fill would be retained by a reinforced concrete retaining wall that would be keyed into the existing roller compacted concrete cofferdam along the westerly perimeter of the parking lot. Access to the powerhouse during periods of heavy precipitation is essential to ensure continuous operation of the powerhouse and prevention of flooding along the canal providing water to the powerhouse. This would involve excavating a new 12-foot wide bench 800 feet along the southwest side of Mormon Ravine above the existing road. This portion of the access road would be relocated above the design flood pool elevation. The existing road would be abandoned. The excavated material from the road would be used as fill to raise grade of the powerhouse parking lot. Access to equipment and machinery in the underground powerhouse would continue from the various hatches in the roof of the powerhouse. The existing hoist on the north side of the powerhouse would be relocated to the top of the ring wall to permit operation between the parking lot and the equipment floor in the powerhouse. Stairs between the parking lot and the powerhouse would provide access to the control building and the powerhouse roof. The station service transformer located on the north side of the powerhouse would be relocated to a site above the design flood pool elevation. Alternatives to above design would be to reduce or eliminate roadwork and raising the parking lot.

Other Areas

There are wastewater pump stations at three of the state park recreation areas that would have to be protected from high water. At this time, an earth fill berm surrounding each pump station is being considered.

Near the intersection of Brown Ravine State Park access road and Green Valley Road, a 60" by 48" culvert crosses Green Valley Road. For the 12-foot raise with a flood pool elevation of 487 feet, the existing culvert would allow water to pass through culvert and flood homes and property on the landside of culvert. On the waterside, a flapgate device on existing culvert would be required and possible extension of culvert.

CHAPTER 2

2.1 Stepped Release Plan to 180,000 cfs Lower American River

Plates 2-1 through 2-15 show plan views of levee features for this plan.

Strengthen Existing American River Levees

From the confluence of the American River and Sacramento River to the Natomas East Main Drain Canal the left bank of the American River levees would be strengthened with a stability berm on the landside of the levee. Clearing, grubbing, and stripping would precede stability berm work. Drain rock would be encapsulated within geotextile and placed at the base of the berm, and then earth fill would be placed on top of drain rock. (See Plate 2-27) A few areas within this reach would require the left bank landside levee to be reshaped to increase the side slope to 2:1. About 13.5 miles of Federal and non-Federal levees would be raised. (See Plates 2-16 through 2-26 for water surface profiles for this plan) Levees would be raised on the water side of the levees as shown on Plate 5-13 in Volume I. Existing levees would have aggregate road base removed, clearing and grubbing in waterside areas of existing levees and proposed footprint, and stripping area from toe of existing levee to the toe of the raised levee. Borrow material for the raise would come from either a 134 acre dredge disposal site near the Port of Sacramento used to maintain the Sacramento Deep Water Ship Channel, or a 62 acre borrow area near Happy Lane and Old Placerville Road. Staging areas are shown on plan views on Plates 2-1 through 2-15. A 10-foot permanent easement would be required at toe of raised levee to inspect and repair levee. (See Table 5-12 in Volume I for a description of work for this alternative)

Existing levees would be strengthened with a slurry wall for a distance of 1.1 miles in the Tiffany Farms - Cordova Meadows area. The slurry wall would be 18 inches wide and 45 feet deep. The top 4 feet of levee would be removed to provide a wider working surface, and provide a ditch where excavated soil and rock can be temporarily stockpiled. Most of the rock would be hauled away. The soil from the ditch would be mixed with cement, water, and bentonite and placed back into the slurry trench. After the slurry has hardened, the levee can be rebuilt back to original shape. The side slopes would be 2:1 on the water (raised) side of levee.

Approximately 2 miles of new levees would be constructed. Most of the new levee work would be between river miles 11.9 to 20. These areas would be cleared, grubbed, and stripped in preparation for the new levee. The new levees would be constructed as shown on Plate 5-12 in Volume I. Approximately 45 feet of base would be needed for new levee as well as a 10-foot permanent easement on the water side of levee to inspect and repair levee. The sides slopes would be 3:1 on the waterside and 2:1 on the landside with a 20' crest width on top of levee.

Approximately 1.7 miles of floodwalls would be constructed as shown on Plate 5-12 in Volume I. Area of footprint would be cleared, grubbed, and stripped. The structural excavation would be required to place below ground portion of floodwall. This work can be done with a backhoe and dozer. The concrete forms and the reinforcing steel would be constructed, and the concrete poured into forms. Compacted earth fill would be backfilled into excavated areas and blended into the surrounding original ground.

Modify Bridges

Three bridges would be raised for this alternative because of the higher water surface elevations. At the Union Pacific Railroad near river mile 2.5 would require a floodgate to be constructed perpendicular to the track direction since this area is lower than the existing levees on each side of railroad. (See Plate 5-22 in Volume I)

The Guy West Bridge would be raised 2.0 feet at each column supporting the suspension cables of the bridge. The approach ramps would be raised to conform to raised bridge. (See Plate 5-23 in Volume I)

The Howe Avenue Bridge crossing consists of a northbound bridge and a southbound bridge, a bridge over La Riviera Drive on the south side of the American River, and the University Avenue Bridge on the north side of the river. These bridges would all have to be raised about 5 feet. In order to allow for the same number of lanes to be open during construction, one new bridge would be constructed at a higher elevation between the existing bridges. When construction of the first bridge has been completed, one of the existing bridges would be demolished, and a second new bridge would be constructed. When the second new bridge has been completed, the second existing bridge would be demolished. The crossings at La Riviera and University Avenue could be constructed within the same construction period as the bridges spanning the river. (See Plate 5-15 in Volume I)

Modify Local Internal Drainage Facilities

The higher water surface profiles caused by the higher volumes of water being released into the American River could adversely affect the operation of many pumping and drainage facilities in the City and County of Sacramento. Table 5-2 in Volume I lists the facilities requiring modifications. Typical schematic of sump is shown on Plate 5-11 in Volume I. Table 5-3 in volume I lists the water intake facilities that require modifications. Plan views of water intake facilities are shown on Plates 2-27 through 2-30.

Relocate Utilities and other Facilities

Many pipelines and other utilities pass through the levees. Increased water surface levels due to increased flows in the river would require modifications to these utilities. Pipes passing through the levees would have to be raised above the probable failure point (PFP) in the levees.

Pipes, which are now below the PFP, would have to be analyzed in more detail during final design to determine whether the pipes need to be raised. Other facilities that would require modifications or relocations include recreation facilities, bicycle trails, roads, fences, signs, as well as other items.

Levee Erosion Protection

Erosion protection would be needed along the levee side slopes at various places along river to protect the levees against higher river water surface elevations and velocities. Approximately 5.8 miles of erosion protection would be needed on the side slopes of the existing levees as shown on Plate 5-12 in Volume I. It is not anticipated that bank protection would be needed along some of the natural channel banks.

2.2 Stepped Release Plan to 160,000 cfs Lower American River

Strengthen Existing American River Levees

From the confluence of the American River and Sacramento River to the Natomas East Main Drain Canal the left bank of the American River levees would be strengthened with a stability berm on the landside of the levee. Clearing, grubbing, and stripping would precede stability berm work. Drain rock would be encapsulated within geotextile and placed at the base of the berm, and then earth fill would be placed on top of drain rock. (See Plate 2-27) A few areas within this reach would require the left bank landside levee to be reshaped to increase the side slope to 2:1. No additional levee raising, new levees, or floodwalls would be required with this plan. Staging and borrow areas would be same as the180,000 cfs plan.

Modify Bridges

No bridges would need to be modified or replaced for this plan.

Modify Local Internal Drainage Facilities

Would be as described for 180,000 cfs plan.

Relocate Utilities and other Facilities

Would be as described for 180,000 cfs plan.

Levee Erosion Protection

Would be as described for 180,000 cfs plan.

CHAPTER 3

3.1 Hydraulic Mitigation on Yolo Bypass, Sacramento River, and Sloughs

Yolo Bypass

Hydraulic mitigation in the Yolo Bypass area would be accomplished by constructing slurry walls, stability berms with drains, stability/seepage berms with drains, and lime treatment within levee earth fill. The work would improve failure conditions of stability, seepage, and boils. A more detailed summary of work can be found in Appendix E - Geotechnical Report.

The right bank of the Yolo Bypass would have five 6000-foot sections of slurry wall. The areas of work are shown on Plates 3-1 through 3-5. Work on the slurry walls begins with removing the first four feet of the levee crest and form a containment ditch that would serve as a temporary stockpile area for the material excavated from trench and also a stockpile area for undesirable materials not to be reused. After the slurry wall trench has been excavated, soil would be taken from the stockpile area and mixed with cement, bentonite, and water, creating the slurry to be placed back into the slurry trench. After the slurry wall has been placed and hardened, the levee can be rebuilt to original shape. By creating the slurry wall, the stability of the levee would improve and an impervious barrier formed to protect against seepage. The midpoints of the 6000-foot areas, which would have slurry wall work, are mile 49.4, mile 47.2, mile 44.9, mile 23.3, and mile 22.1. The mile 50.0 point is near Interstate 5 and the Sacramento International Airport.

Between mile 27.7 to mile 28.0, the right bank of the Yolo Bypass would be stabilized with a 2500-foot long by 12-foot wide land side stability berm, and between mile 25.5 and 27.7 a 10,000-foot long by 12-foot wide stability berm as shown in Plates 3-7 and 3-8. Prior to placing rock and berm area would be cleared, grubbed, and stripped. Drain rock would be placed before earth fill berms are constructed, and the drain rock would be encapsulated within geotextile for both of these reaches as shown in Plate 3-B. Borrow area would be from Grand Island dredge disposal site.

The left bank of the Yolo Bypass would have the top 4 feet of soil treated with lime to increase the stability of levee. The area of this work would be from mile 50.0 to 44.2, which would be from Interstate 5 to the Sacramento Weir as shown in Plate 3-6, and sample cross section Plate 3-E.

Cache Slough

There would be three areas along Cache Slough where berms would be constructed. Prior to placement of berm, area would be cleared, grubbed and stripped. The first would be stability/seepage berm 400 feet long by 25 feet wide on the left bank as shown in plan view on Plate 3-9, and cross section on Plate 3-C. Borrow area for all berm work would be taken from Grand Island dredge disposal site. The area of this work would be near the confluence of Cache Slough and Hass Slough. The second would be a stability/seepage berm, which is 2500 feet long by 12 feet wide as shown on Plate 3-9 and on cross section 3-B. This area is adjacent to stability/seepage berm above. The third stability berm would be a stability/seepage berm, which is 1200 feet long by 45 feet wide as shown on Plate 3-10 and cross section on Plate 3-A. This stability/seepage berm is similar to the second except the width is 45 feet instead of 25. The area of this work is on the southwestern portion of Ryer Island.

Sacramento River

The Sacramento River would have one area with a stability berm, which would be about one mile south of the town of Ryde as shown on Plate 3-11 and cross section on Plate 3-B. This stability/seepage berm would be 12 feet wide by 1000 feet long. Clearing, grubbing and stripping would precede placing berm.

Sutter Slough

Sutter Slough would have two areas with stability berms. The first area along Sutter Slough would be a stability berm 600 feet long by 25 feet wide as shown in Plate 3-12 and cross section on Plate 3-D, and another 730 feet long by 25 feet and shown on Plate 3-D and on typical cross section Plate 3-C. This area is about 2000 feet north of the confluence of Sutter Slough and Miner Slough. The second would be on left bank near the confluence of Sutter Slough and Steamboat Slough as shown on Plate 3-13 and cross section on Plate 3-B. The stability berm would be 1500 feet long and 25 feet wide. All work on Sutter Slough would require clearing, grubbing, and stripping prior to berm placement.

Steamboat Slough

Steamboat Slough would have six areas of berms. Clearing, grubbing, and stripping would be completed prior to placement of berms. The first area would be at mile 16.4, which is about 2 miles upstream of confluence of Steamboat Slough and Cache Slough. A 2500-foot long by 45-foot wide stability/seepage berm would be constructed as shown on Plate 3-14 and cross section on Plate 3-A. The second area is at mile 19.5 near Walker Landing. A 2000-foot long by 45-foot wide stability/seepage berm would be constructed as shown on Plate 3-15 and cross section on Plate 3-A. The third area is at mile 20.2 south of Howard Landing. A 2500-foot long by 45-foot wide stability/seepage berm would be constructed as shown on Plate 3-16 and cross section on Plate 3-A. The fourth area is at mile 21.2 north of Howard Landing. A 300-foot long by 25-foot wide seepage berm would be constructed as shown on Plate 3-17 and cross section on Plate3-C. The fifth area is at mile 23.2 near River Mansion. A 1500-foot long by 12-foot wide stability/seepage berm would be constructed as shown on Plate 3-18 and cross section Plate 3-B. The sixth area is at mile 25.5 near the Sacramento River. An 8000-foot long by 12-foot wide stability/seepage berm would be constructed as shown on Plate 3-19 and cross section Plate 3-B.

Sacramento Weir and Bypass

The Sacramento Weir and Sacramento Bypass would have to be widened by 1000 feet to efficiently pass an additional 30,000 cubic feet per second (cfs) additional water through the bypass. The new weir would consist of 25 forty-foot-wide bays to the north and adjacent to existing weir. See Plate 5-14 in Volume I for plan view of widening plans. This would involve a temporary detour of a road and a railroad during construction. During construction, the alignments of the new roadway and railroad would be completed. A new levee would be constructed on the north side of new widened weir. The material from the existing levee on the north as well as a cross levees would be used to construct new levee. A material from landfill would be removed. Two pumping stations and a gaging station would be relocated. Plate 3-F shows typical section through bay and pier footing details.